PIGMENTED VILLONODULAR SYNOVITIS IN CHILDREN: A REPORT OF SIX CASES AND REVIEW OF THE LITERATURE

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ABSTRACT

We report six children with pigmented villonodular synovitis. They ranged in age from seven to fifteen years. In four patients, the knee was involved. One patient had involvement of the ankle, and one had diffuse involvement along a metacarpal. In five cases, the diagnosis was not suspected clinically or radiographically, and the delay in making the correct diagnosis was as long as two years. Clinical diagnosis in these five patients was usually bacterial synovitis or juvenile rheumatoid arthritis. We feel that the diagnoses of pigmented villonodular synovitis should be considered in any child with chronic joint effusion.

Pigmented villonodular synovitis (PVNS) is a disease of synovial membrane characterized by a proliferation of mononuclear cells, probably of histiocytic origin, deep to the synovial lining cells. In addition to mononuclear cells, multinucleated giant cells, foam cells, and hemosiderophages are present in varying amounts. As a result of these cells, the synovial membrane, either intraarticular or extraarticular, is transformed into thickened brownish nodules and greatly elongated villi. Pigmented villonodular synovitis occurs in one of two growth patterns—a localized nodule or a diffuse villous hyperplasia of large portions of synovial membrane. The localized form, when arising in tenosynovium, is sometimes called giant cell tumor of tendon sheath.

The etiology of pigmented villonodular synovitis is uncertain. Because many of the mononuclear cells show trisomy 7, a feature which suggests clonality, a neoplastic origin is possible.[1] A neoplastic origin is further supported by the observation that some cells in this process are aneuploid.[2] Another observation has confirmed the histiocytic differentiation of the mononuclear cells—most contain the histiocyte markers Leu-M3 and Leu-3.[3]

Pigmented villonodular synovitis most commonly affects adult patients in the third of fourth decades of life. Patients present with joint pain, swelling, and stiffness. Although any joint may be affected by PVNS, the knee is the most common site, involved in 80 percent of cases. Other joints frequently involved are the hip, shoulder, and ankle. Usually only one joint is affected. Pigmented villonodular synovitis is rare in children and may present diagnostic problems. We are presenting six children with PVNS. We studied the clinical history, histologic features, and radiographic images of their lesions (Table 1).

CASE HISTORIES

Patient One

A seven-year-old girl had a swelling on the small finger of her right hand for three months. The swelling was confined to the volar aspect of the PIP and MCP joints. There was no history of an injury, and laboratory studies were normal. An open biopsy demonstrated pigmented villonodular synovitis. The lesion was excised. Over the next five years, the patient developed four recurrences of this lesion with diffuse involvement of the flexor tendon sheath. Each time the lesion was excised in its entirety. Since the last excision, the patient has not had a recurrence in two years. Despite multiple surgeries, she has full range of motion in the small finger with slight stiffness in the metacarpophalangeal joint.

Patient Two

An eight-year-old boy had a two-month history of swelling in his right knee. He was in otherwise good physical health but had shown some developmental delay of uncertain origin. An MRI of the knee showed a joint effusion and thickened synovial membrane in

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Each author certifies that his or her institution approved the reporting of this case series, that all investigations were conducted in conformity with ethical principles of research, and that informed consent was obtained.

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TABLE 1
Pigmented Villonodular Synovitis in Children

Patient	Age/Sex	Location	Presentation	Radiology	Pre Op Dx	Treatment	Follow-Up
Patient 1	7/F	Right hand, fifth finger	Painful swelling	Non-specific	Tumor	Synovectomy x5	Four recurrencess, two years disease free
Patient 2	8/M	Right knee	Two months pain and swelling	Synovial inflammatory process	Juvenile rheumatoid arthritis	Arthroscopic Synovectomy x3	Two recurrences, five years disease free
Patient 3	11/F	Right knee	Acute painful swelling	Synovial mass	Bacterial synovitis/juvenile rheumatoid arthritis	Arthroscopic synovectomy	One year disease free
Patient 4	11/F	Right knee	Six months swelling and pain	Synovial mass	Bacterial synovitis/juvenile rheumatoid arthritis	Arthroscopic synovectomy	Two years disease free
Patient 5	15/M	Right knee	One year pain and swelling	Pathologic synovial mass	Synovitis	Arthroscopic synovectomy	Three years disease free
Patient 6	13/M	Right ankle	Two years pain and swelling	PVNS	Rheumatologic process	Arthroscopic synovectomy	Two years disease free

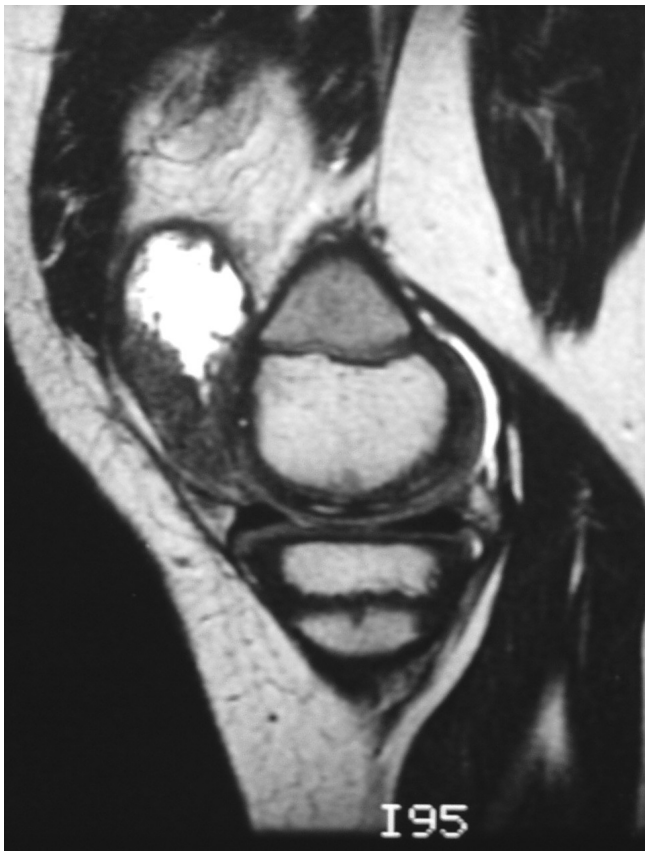

Figure 1: A T2-weighted MRI of knee of patient two. There is an effusion and synovial thickening in the anterior portion of the joint.

the anterior compartment, suggestive of a synovial inflammatory process (Figure 1). Juvenile rheumatoid arthritis was suspected, but laboratory studies were normal. After following the patient clinically for a year, he underwent an arthroscopic synovectomy, with the specimen showing pigmented villonodular synovitis. Over the next two years, he required two additional arthroscopic synovectomies to completely remove the affected synovial membrane. Five years after the last surgery, there was no evidence of recurrence, and he had full range of motion.

Patient Three

An 11-year-old girl developed a sudden painful swelling of her right knee. In the emergency room, she was felt to have bacterial synovitis, so she was hospitalized and treated with IV antibiotics. Because bacterial cultures were negative, the working diagnosis was changed to juvenile rheumatoid arthritis. However, workup for this disease was negative. She was followed for a year with intermittent increases in the swelling. Plain radiographs showed normal bone structure, but an MRI showed a synovial mass in the posterior aspect of her knee joint (Figure 2). She underwent a needle biopsy, which showed pigmented villonodular synovitis. Subsequently, she had an arthroscopic synovectomy of the knee. One year post-op she is doing well with no recurrence.

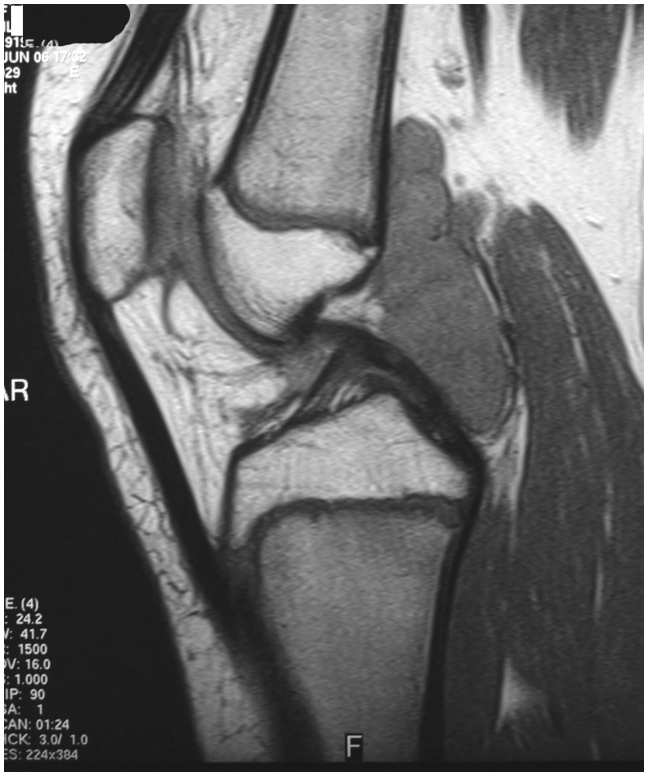

Figure 2. A T1-weighted MRI of the knee of patient three. There is an intraarticular mass in the posterior aspect of the joint.

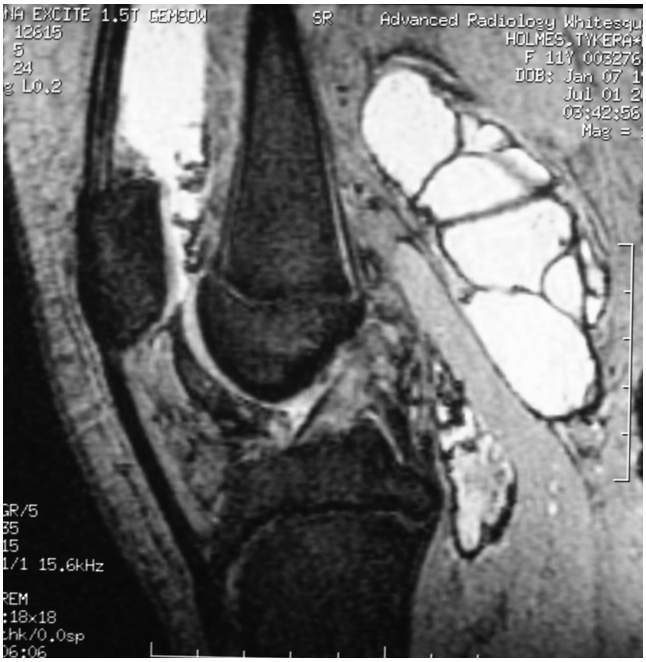

Figure 3. A T2-weighted MRI of the knee of patient four. There is significant effusion in periarticular bursae as well as diffuse synovial thickening.

Patient Four

An 11-year-old girl had a six-month history of a swollen and tender right knee. There was no history of trauma, and laboratory values were within normal limits. Aspiration showed no evidence of an organism, although septic synovitis was the principal diagnosis. The differential diagnosis also included juvenile rheumatoid arthritis. An MRI showed a joint effusion with synovial hyperplasia (Figure 3). The patient was then felt to have juvenile rheumatoid arthritis. The patient underwent an arthroscopic synovectomy for diagnostic purposes. During the synovectomy, the synovial membrane was notably hypertrophic throughout the entire knee. The tissue diagnosis was pigmented villonodular synovitis. She is doing well two years post-operatively and continues to be asymptomatic.

Patient Five

A 15-year-old male had a one year history of increasing right knee pain and swelling following a car accident. A mass gradually developed over the lateral aspect of the right knee. The patient had no history of an infectious illness or a rheumatologic disorder, and his laboratory values were normal. An MRI of the knee showed a poorly defined 5 cm mass in the intrapatellar fat pad and was interpreted as a "pathologic synovial process." A diagnostic arthrotomy showed the knee to be filled with brown hyperplastic synovial membrane. Biopsy of the synovium revealed PVNS. The synovium was extensively debrided. Three years post-operatively there is no evidence of recurrence, and the patient is asymptomatic.

Patient Six

A 13-year-old boy had pain and swelling in the anterior aspect of his ankle for two years. His pediatrician suspected a rheumatologic disorder and referred the patient to an orthopaedic surgeon. Clinically there was a 3-4 centimeter mass in the anterior aspect of this ankle joint (Figure 4). An MRI was highly suggestive of pigmented villonodular synovitis. A needle biopsy demonstrated PVNS, and the patient subsequently underwent an arthroscopic synovectomy. There were osteochondral defects of the dome of the talus, and these were treated by chondroplasty. Two years post-operatively the patient is pain free, with no evidence of recurrence.

DISCUSSION

These six cases highlight the frequent delay in diagnosing PVNS in children. In fact, in only one case (patient six) was the diagnosis considered prior to surgery. Most cases were followed for at least a year with varying diagnoses, the most common being juvenile rheumatoid

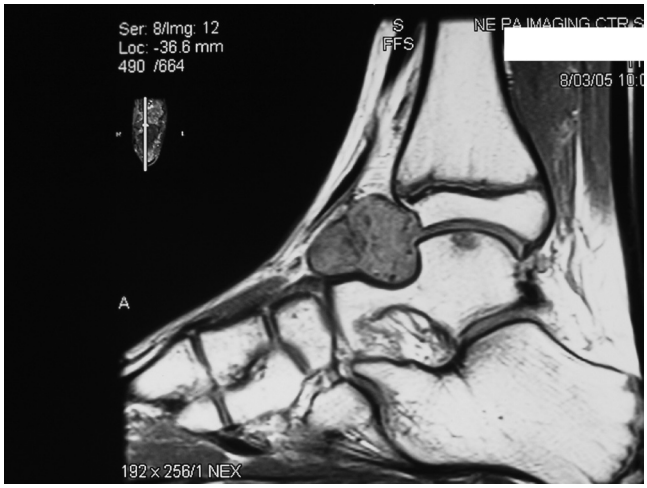

Figure 4. A T1-weighted MRI of the ankle of patient six. The mass in the anterior portion of the joint shows signal dropout consistent with PVNS. There is also a chondral defect in the dome of the talus.

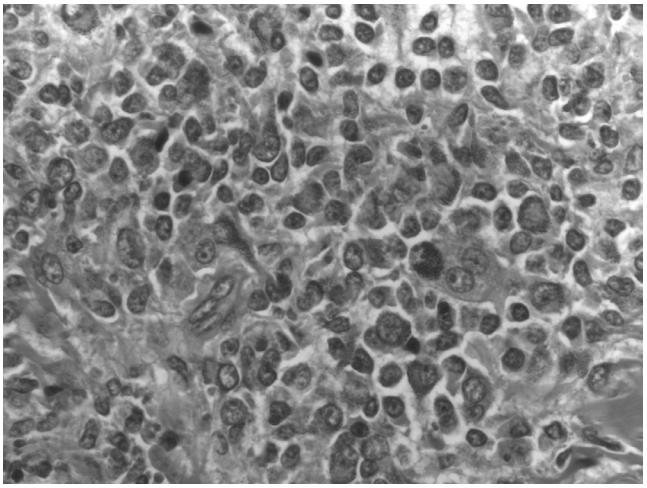

Figure 5. Photomicrograph of the lesion of patient six. Mononuclear cells characteristic of PVNS contain hemosiderin (H&E, x120).

arthritis or bacterial synovitis. Eventually, each patient underwent a tissue sampling, with the histologic features of the lesional tissue diagnostic of PVNS. The histologic features of these lesions were no different than those in adults (Figure 5). The radiographic features showed a spectrum of involvement varying from diffuse synovial hyperplasia with extensive effusion to an isolated discrete intra-articular mass. In adults, bone erosion secondary to the synovial proliferation occurs in almost 50% of cases.[4] However, in only one of these six children was there evidence of bone erosion (patient six).

There are 25 cases of unifocal pigmented villonodular synovitis in children in the literature.[5-21] The youngest patient was eight months.[12] In addition to these 25 cases, three cases of presumed PVNS were associated with hemangiomas of the skin overlying the affected joints.[22] These cases may represent examples of vascular proliferation in synovial membrane, a process known to mimic PVNS.[23]

As in our cases, the diagnosis of pigmented villonodular synovitis was not suspected clinically in most reported cases. Pre-operative diagnosis included ganglion cysts,[17] septic arthritis,[9] juvenile rheumatoid arthritis,[5] soft-tissue sarcoma,[12] and bone neoplasms.[13]

Adults may rarely develop pigmented villonodular synovitis in multiple joints. Children may also develop polyarticular disease. There are twelve reported cases of pigmented villonodular synovitis in children which involve several joints either synchronously or metachronously.[24-34] The youngest of these patients was four years of age.[32] Most of the children with polyarticular disease have other congenital problems suggesting a possible genetic basis for this syndrome. Skin lesions have been reported,[29] as well as pulmonary stenosis with or without mental retardation,[25,26] Noonan syndrome[31] and fetal hydantoin syndrome.[28] In these children, the histologic and radiographic features of the synovial lesions are similar to lesions in other children.

These six new cases confirm the findings of previously reported cases that pigmented villonodular synovitis occurs in children and that it is often not diagnosed promptly. Pigmented villonodular synovitis should be considered when a child presents with a painful swollen knee and laboratory and clinical studies do not support a diagnosis of bacterial synovitis or juvenile rheumatoid arthritis. These six cases suggest that arthroscopic synovectomy is the treatment of choice.

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